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MODELS OF FINANCING RESEARCH: PUBLIC FUNDING MECHANISMS FOR UNIVERSITIES IN FLANDERS

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Abstract: *This paper gives an overview of the models of financing research at universities in Flanders, Belgium. The Flemish government installed parallel mechanisms to distribute financial means for scientific research at the universities: research is supported via the allocation of block grants to the universities based on specific interuniversity allocation keys on the one hand and via project-based funding allocated on competitive basis by public funding agencies on the other hand. The composition of the allocation key of both the Special Research Fund and the Industrial Research Fund and the impact of the research performance-based parameters of these allocation keys on the research policy of universities and on the peer-reviewed assessment of the quality of research proposals submitted to the Fund for Scientific Research – Flanders, one of the Flemish public funding agencies, are discussed.*

Keywords: *allocation key, block grant funding, research performance-based parameter, competition-based funding, project-based funding.*

1. INTRODUCTION

Funding is a crucial factor to perform excellent scientific research. It allows principal investigators to set up their research activities by hiring young potential researchers, by getting access to up-to-date research infrastructure, databases and libraries, and by acquiring the necessary consumables to do the experiments and all other types of research activities in a proper way. It is up to the principal investigators to look for the most appropriate funding opportunities and to submit an excellent research proposal. In their search for research funding they can appeal to the staff members at the central administration of their institution dealing with the follow-up of a number of funding opportunities. Staff members at the research co-ordination offices, technology transfer offices and international relation offices are best placed to inform and support the university principal investigators in their attempts to acquire research funding.

Van Dalen et al. (2014) distinguished 3 types of funding contracts between governments and public research performing institutes: *ex-post* funding (corresponding to block grant funding based on research performing output), *ex-ante* funding (corresponding to project-based funding) and fixed funding (a specific type of block grant funding for which the government does not monitor output and leaves control to the institute concerning the allocation of funds). Seen from the point of view of the university policy makers, the public research funding landscape shows two main types of funding schemes: block grant funding and project-based funding. Block grant funding allows the institution to set its own research priorities while the government, in most cases, monitors research efforts and research output closely. Project-based funding allows the funding agency (and in case of a governmental funding agency, the government behind it) to set its own priorities and offers principal investigators the opportunity to respond to these priorities.

The decentralization and devolution of the Belgian federal policy authority towards the regions and communities in the country as from the early 90's made it possible that the science and technology policy became a major component of regional policy making. In Flanders, which is the Dutch-speaking part of the country geographically situated in the northern half of the country, the Flemish government installed several parallel mechanisms to distribute financial means for scientific research at the universities (Debackere & Glänzel, 2004). Fundamental research at universities is supported via 1) the distribution of funding through the Fund for Scientific Research – Flanders which is a funding agency launching competitive calls for proposals for doctoral and postdoctoral fellowships, research projects and initiatives to set up international research consortia, among others, and 2) the allocation of a block grant to the universities based on a specific interuniversity allocation key composed of merely research performance-based indicators: the so-called Special Research Fund (*Bijzonder Onderzoeksfonds*; BOF). A similar parallel mechanism has been installed to fund strategic and applied research at universities: 1) a competition-based distribution via several funding agencies that launch on regular basis competitive calls for proposals for a variety of initiatives and 2) a research performance-based distribution of a block grant to the universities called the Industrial Research Fund (*Industrieel Onderzoeksfonds*; IOF). To determine the yearly share of financial means of the Industrial Research Fund for each Flemish university, a specific interuniversity allocation key has been developed. Some

of the research performance-based parameters present in the BOF allocation key are also part of the IOF allocation key.

Several authors and international organisations investigated the research policy measures of national and regional governments by comparing the funding mechanisms used to support and stimulate research activities at university level (European Commission, 2008; Auranen & Nieminen, 2010; Butler, 2010; Lewis & Ross, 2011; Ecker et al., 2012; Hicks, 2012; van Dalen et al. 2014). These studies show that several national and regional governments apply a variety of performance-based funding methods for research in public universities.

In this paper, a number of specific funding schemes of the Flemish government are considered. Their description, goals and priorities, and modalities will be discussed in order to give the readers insight in their specificities and accents put forward by the government and or the funding agency. In a first part, the Special Research Fund (*Bijzonder Onderzoeksfonds; BOF*) and the Industrial Research Fund (*Industrieel Onderzoeksfonds; IOF*), 2 block grants offered by the Flemish government to allow universities to set up and support their own research policy, will be described. The allocation of funding to the universities for each of these 2 university research funds is based on a specific allocation key consisting of research performance-based parameters (BVR, 2009; BVR 2012).

A second type of block grant that will be discussed in this paper deals with the funding principles of the autonomous Institute for Biotechnology (*Vlaams Instituut voor Biotechnologie, VIB*). The VIB is one of the Flemish strategic thematic research institutes that has been set up over the years in Flanders. This institute is included in this study because it is set up as a virtual research institute: apart from a central administrative unit, all the other units (research departments) are integrated within universities. For the more than 1,300 researchers of these research departments the mechanisms used to fund this virtual strategic research institute are at least as important as the mechanisms used to fund research at universities (block grant funding methods as well as competition-based funding methods). The VIB is not the only virtual research institute in Flanders. Another research institute is iMinds, Flanders' digital research center. Its research departments are also integrated within the universities. The more than 850 researchers conduct strategic and applied research in areas such as ICT, Media and Health.

A third type of research funding is solely based on competition between individual research proposals submitted by the professorial and research staff of the universities. As an example the Fund for Scientific Research – Flanders (*Fonds voor Wetenschappelijk Onderzoek – Vlaanderen; FWO*) is introduced. This funding agency signs a management agreement with the Flemish government every 5 years in which the modalities by which the funding agency has to distribute funds through competition-based funding are described. In implementation of these modalities, the FWO launches several calls for proposals per year and sets up a competitive selection procedure based on peer review in order to fund only the best research proposals.

The composition of the allocation keys set up by the Flemish government is of vital importance to the strength of the research policy of each university. The characteristics of the parameters and the use of weighting factors were decided by the government after consultation of the interuniversity council (comprising all vice-chancellors of the Flemish universities). As the size of the universities in Flanders considerably differs, the allocation keys have to be the result of a well-balanced combination of the interests of each of the universities. Besides the 2 full-fledged universities (KU Leuven and Ghent University), there are also 2 medium-sized universities (Vrije Universiteit Brussel and the University of Antwerp) and 1 small-sized university (University of Hasselt). The allocation keys have to provide an incentive to improve the research performance of the whole higher education segment in Flanders as well as to meet the needs of the individual universities to support their own research policy.

2. ALLOCATION KEY OF THE SPECIAL RESEARCH FUND

The aim of the BOF allocation key is to distribute public research and development funding between the Flemish universities. It is up to each university to use the R&D funding to set up and support a university-wide research policy with emphasis on fundamental research. For this purpose each university established a research council with a two-fold mission: 1) to prepare research related university-wide policy measures and 2) to organize intra-university funding allocation systems based on peer-review mechanisms to support individual research initiatives in accordance with the current research policy measures. At Ghent University a portfolio of funding initiatives (projects, PhD fellowships, postdoctoral fellowships, small-scale research infrastructure, mobility schemes,...) have been developed. Annual or biannual calls for proposals are launched

within the university. In that sense is the university its own research funding agency using the research council and its specific evaluation panels as actors in the selection of the “best” research proposals.

2.1. First version of the allocation key

The Special Research Funds have been installed at each Flemish university by a Flemish Resolution in 1994 (Debackere & Glänzel, 2004). Up till 2002 the allocation key consisted of 3 parameters: the university share in the total number of PhD degrees awarded during a moving time frame consisting of the 4 most recently concluded academic years (50%), the university share in the total number of academic (master) degrees awarded during the same moving time frame (35%), and the university share in the total university basic allowance of the most recently concluded calendar year (15%).

The PhD degrees were weighted to differentiate for the differences in research costs among research disciplines. The coefficients of weight used were 1, 2 or 3 in order to differentiate between the Arts, Humanities and Social Sciences, the Natural Sciences and (Bioscience-) Engineering, and the (Bio)medical Sciences respectively. The use of the university share in the total basic allowance was included as parameter to take into account the differences in size between the Flemish universities. The parameter considering the university share in the total number of academic (master) degrees awarded had a similar function while it also was considered to be an input parameter to measure the pool of young people who had the potential to start a research career at the university. A moving time span of 4 academic years was installed to avoid too strong fluctuations between 2 subsequent budgetary years as this could hamper the continuation of the implementation of the research policy of the individual universities (Debackere & Glänzel, 2004; Spruyt & Rons, 2008).

2.2. Modifications to the allocation key over the years

In 2003 the Flemish government decided to adapt the BOF allocation key in order to stimulate the scientific output at the universities and to enhance the visibility and impact of their scientific results. This resulted in the introduction of 2 new parameters: the university share in the total number of scientific publications and the university share in the total number of citations to these publications. Only publications indexed by the databases of Thompson Scientific (Web of Knowledge – Science Citation Index Expanded) were eligible. A moving time frame consisting of the 10 most recent calendar years was implemented in order to obtain sufficient robustness in these parameters as too strong fluctuations among subsequent budgetary years had to be avoided. Another concern had to deal with the citation period of publications which varies significantly between scientific disciplines. A time frame of 10 years was installed in order to capture a significant number of citations that otherwise would have been “lost” in those disciplines with a rather slow citation rate in the first years after publication (Debackere & Glänzel, 2004).

The share of each of these 2 parameters was 5% in 2003 and increased up to 15% each in the budgetary years 2005 and 2006. At the same time the total share of the other 3 parameters was proportionally reduced.

Starting from 2007 an additional parameter (with a starting share of 6% at the expense of the parameter based on the university share in the total university basic allowance) was included in the BOF allocation key: the diversity and mobility coefficient (Spruyt & Rons, 2008). The decision to introduce this parameter was based on the observations that few women were part of the professorial staff at the Flemish universities and that only a minority of the members of the professorial staff obtained their PhD degree at another university than the Flemish university who appointed them. Therefore the new parameter took into account the university share in the total number of newly appointed female professors in Flanders as well as the university share in the total number of all newly appointed professors who did not obtain their PhD at the appointing university among all newly appointed professors. The goal of this new parameter clearly was 1) to speed up the inflow of women in the professorial staff, 2) to reduce the “inbreeding” of young postdoctoral researchers at the level of the professorial staff and 3) to stimulate the national as well as international mobility prior to an appointment as professor.

It became clear after a few years that this parameter did not show sufficient robustness (Spruyt & Engels, 2013). This was due to the too small numbers that had to be taken into account each year causing strong fluctuation between the university shares over the years. In order to solve this unwanted side effect the focus of the parameter was reduced to concentrate solely on the gender aspect. The adapted parameter only takes into account the university share in the total number of postdoctoral female academic (professorial + research) staff members (expressed in full time equivalents) measured over a moving time frame of 4 calendar years. The share of this parameter in the BOF allocation key has simultaneously been reduced to 2%.

Starting from 2008 quality assurance aspects were introduced on the level of the publication parameter of the BOF allocation key: instead of counting the total “raw” number of publications, the parameter was redesigned to take also into account (for 50%) the impact factor of the journals in which the scientific results are published. This modification is based on the assumption that the impact factor of a scientific journal is a good approximation of the particular quality of the results published in that journal. As a result of this assumption the absolute impact factor of the journals in which publications of Flemish university researchers appeared was taken into account to determine the share of each university in this parameter.

Whether a publication in a journal with a high impact factor contains by definition excellent research results is food for discussions. One can even pose the question whether a journal with a high impact factor is the most appropriate journal to publish in for researchers active in the research domains that are covered by that journal. A journal which focusses on a limited number of specific research domains (but with a less high impact factor) might have a better visibility in these specific research domains and as a consequence might yield more citations to the published work in that research domain.

As of 2008 onwards the publications in journals covered by the Social Science Citation Index (SSCI), the Arts and Humanities Citation Index (AHCI), the Conference Proceedings Citation Index-Science (CPCI-S) and the Conference Proceedings Citation Index-Social Sciences & Humanities (CPCI-SSH) were also taken into consideration in the framework of this parameter. This was a first step in the further spread of research disciplines of which publications were taken into account in the BOF allocation key (Spruyt & Rons, 2008).

A second step in the further spread of research disciplines was taken in 2011 as a regional database was set up to obtain full coverage of publications of the Flemish social scientists and humanities scholars: the Flemish Academic Bibliographic Database for the Social Sciences and Humanities ('Vlaams Academisch Bibliografisch Bestand voor de Sociale en Humane Wetenschappen' (VABB-SHW)). Publications indexed in this database (excluding the publications indexed in the before-mentioned Thomson Reuters' databases (SCEI, SSCI, AHCI, CPCI-S and CPCI-SSH)) were from then on also taken into account to determine the share of the universities in the BOF allocation key. This new academic bibliographic database was set up after the example of an academic bibliographic database set up in Norway (Schneider, 2009; Sivertsen, 2010). The main (and only) goal of this Flemish database is to nourish and expand the publication parameter of the BOF allocation key towards the Flemish scientific peer-reviewed output in the fields of Arts, Humanities and Social Sciences regardless of the language of the scientific publication or of its geographical dimension. The added value of this database when compared to the Thomson Reuters' databases is that the VABB-SHW is not limited to the scientific contributions written in English as is mainly the case for the Thomson Reuters' databases. In contrast to the lingua franca of most scientific publications in the fields of Natural Sciences, (Bioscience-) Engineering and (Bio-) Medical Sciences, publications in the Arts, Humanities and Social Sciences are more often written in the local language of the researchers or appear as books or book chapters by (regional) scientific publishers. So, in order to be able to take into account all qualitative (i.e. peer reviewed) scientific contributions of the researchers active in the fields of Arts, Humanities and Social Sciences in Flanders, this specific database had to be set up. The objectives, design and selection process of this Flemish academic bibliographic database have been described in detail by Engels et al. (2009), Ghesquière et al. (2011), Ossenblok et al. (2013), and Verleysen et al. (2014).

The VABB-SHW database only accepts publications of Flemish authors affiliated to universities (and non-university institutes of higher education) on condition that at least one of the co-authors is affiliated to a university unit linked to Arts, Humanities or Social Sciences. In order to distinguish between the different types of publications weight factors for each publication type were introduced. The coefficients of weight at the onset of the VABB-SHW database range between 4 (book (co-)author), over 2 ((co-)editor of a book) and 1 ((co-)author of a book chapter, an article in a scientific journal or a conference proceeding) (Engels et al. (2009)).

In 2014 a minimum share in the subsidy of the Special Research Fund for the 3 smallest universities has been guaranteed: 2.91% for the University of Hasselt, 10.12% for the Vrije Universiteit Brussel and 11.75% for the University of Antwerp. These minimum shares may increase to 4%, 10.5% and 13% respectively on condition a number of specific research performance-based goals are reached in the near future (but not earlier than 2017). It is believed the universities concerned will reach these goals within a timeframe of 4 years leaving only 72.5% of the subsidy of the Special Research Fund submitted to the characteristics of the allocation mechanism of the BOF allocation key.

2.3. The current BOF allocation key

The BOF allocation key used in the budgetary year 2015 contains 6 parameters. The parameters are bundled in 2 parts: a so-called structural part A and a bibliometric part B (BVR, 2012).

The structural part of the allocation key is the weighted average of three parameters:

- Parameter A1: the share of each university in the total number of undergraduate (master) degrees awarded by the Flemish universities;
- Parameter A2: the share of each university in the total number of PhD graduates (PhD degrees awarded) by the Flemish universities;
- Parameter A3: the share of each university in the diversity parameter.

A moving time span of 4 academic years (parameters A1 and A2) and of 4 calendar years (parameter A3) is taken into consideration to determine the share of each university in each of these 3 parameters.

The bibliometric part of the allocation key consists of three parameters aiming at the stimulation of the productivity and international quality of the scientific research at the universities in Flanders. The parameters are:

- Parameter B1: the number of publications of the types 'Article, Letter, Note, Review, or Proceedings paper' in peer reviewed journals covered by the Science Citation Index Expanded (SCIE), the Social Science Citation Index (SSCI), the Arts and Humanities Citation Index (AHCI), the Conference Proceedings Citation Index-Science (CPCI-S) and the Conference Proceedings Citation Index-Social Sciences & Humanities (CPCI-SSH). These databases are managed by Thomson Reuters. All Flemish higher education institutions have access to these databases.
- Parameter B2: the number of publications covered by the Flemish Academic Bibliographic Database for the Social Sciences and Humanities excluding the publications indexed in the before-mentioned Thomson Reuters' databases.
- Parameter B3: the number of citations to the publications indexed in the before-mentioned Thomson Reuters' databases.

A scientific publication is assigned to a university as soon as the university is mentioned in the address of at least one of the authors of the publication. In case of a Flemish interuniversity collaboration the publication is assigned as one "full" publication to each of the universities involved. Publications realised in a moving time span of 10 calendar years are taken into consideration to determine the share of each university for the parameters B1, B2 and B3.

2.3.1. Parameter A1: bachelor and master degrees

This parameter in the BOF allocation key is seen as a measure for the research potential of each university based on its own undergraduates. This parameter also reflects the investment in scientific research in the fields of the education offered to the students (Spruyt & Rons, 2008).

The share of each university in the total number of undergraduate degrees awarded by the Flemish universities is counted over a period of the 4 most recent academic years for which the degrees have been ratified by the government. This parameter takes into account 2 types of academic degrees: the initial master degrees awarded by all universities as well as the initial bachelor degrees awarded by universities that do not have the authority to organise the subsequent master programme. The latter type of degrees has been included to reward the efforts of incomplete universities to educate and teach students in the programmes for which they only have the authority to offer the bachelor training. In fact these students are counted twice: a first time when they obtain their bachelor degree and a second time when they obtain, at another university in Flanders, their subsequent initial master degree.

Weighting factors linked to discipline-related differences in the costs of offering excellent education and of performing research activities are used in the formula to calculate the share of each university. The weight of this parameter within the BOF allocation key has evolved over the years and attains 24% in 2015 (Figure 1) and will be reduced to 23% in 2016 (BVR, 2012).

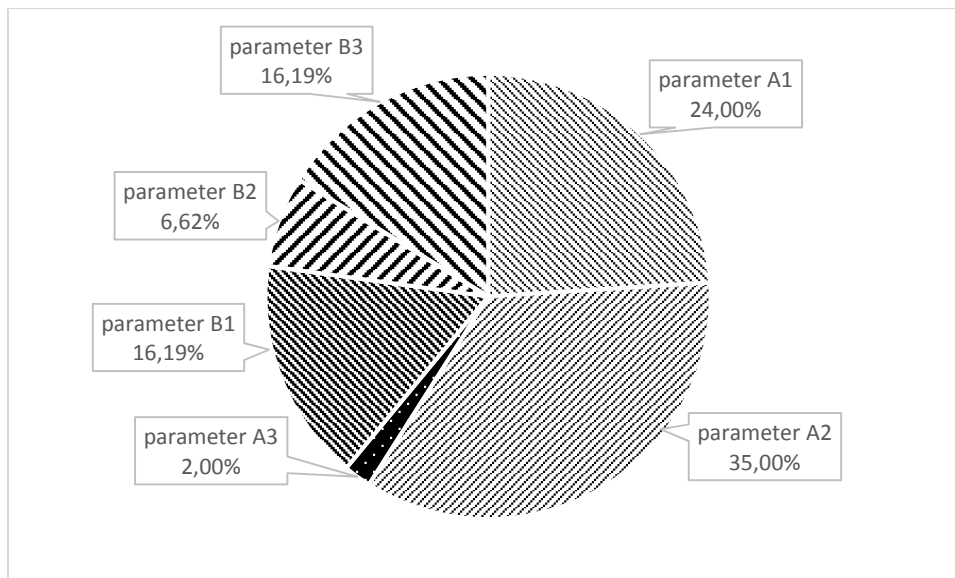


Figure 1: The share of each parameter in the BOF allocation key 2015

2.3.2. Parameter A2: PhD degrees

PhD degrees have been taken into account from the onset of the allocation key in 1995. In 2015 the share of each university in this parameter is determined using a combination of two counting methods: on the one hand the total number of PhD degrees are counted over a time span of 4 recent academic years, on the other hand Ph.D.'s are weighted using a (1,2)-weighting criterion depending on the discipline in which the Ph.D. occurs and then counted over the same time span. The share of each university is determined by considering the university share in the total number of non-weighted PhD degrees for 25% of the parameter and the university share in the total number of the weighted PhD degrees for 75%.

For the purpose of this parameter a Ph.D. in Arts, Humanities, Social Sciences or Behaviour Sciences has a weight of 1 whereas a Ph.D. in Natural Sciences, Engineering, Bioscience Engineering, Veterinary Sciences, Biomedical Sciences, Pharmacy, Medicine or Health Sciences has a weight of 2. These weights are based on the differential cost estimates of doing doctoral work in the various research disciplines. These weights are the same for all universities.

The occurrence of this parameter in the allocation key from the very start of the allocation key is considered to be the onset of taking into account a first aspect of the scientific output of university research activities. The weighting criteria within this parameter have been simplified over the years but the weight of the parameter in the allocation key remained relatively stable. This parameter accounts for 35% in 2015 (Figure 1) and subsequent budgetary years (BVR, 2012). For the BOF budgetary year 2015 a share of 35% in the BOF allocation key corresponds to approximately EUR 50 million.

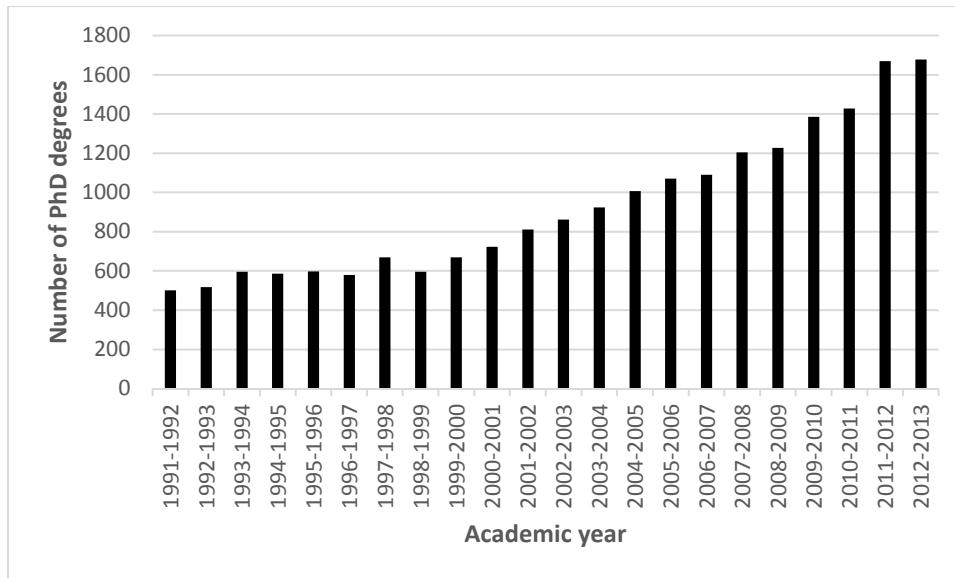


Figure 2: Number of PhD degrees awarded in Flanders per academic year for the period starting with the academic year 1991-1992 till academic year 2012-2013. (retrieved from Vandeveldel et al. (2013) and Smet (2014))

The evolution of the total number of PhD degrees awarded in Flanders is shown in Figure 2. A significant increase in the annual number of PhD degrees awarded is observed over the years: while in the academic year 1991-1992 501 PhD degrees were awarded, the number of degrees more than tripled in recent years reaching 1678 PhD degree in the academic year 2012-2013 (retrieved from Vandeveldel et al. (2013) and Smet (2014)).

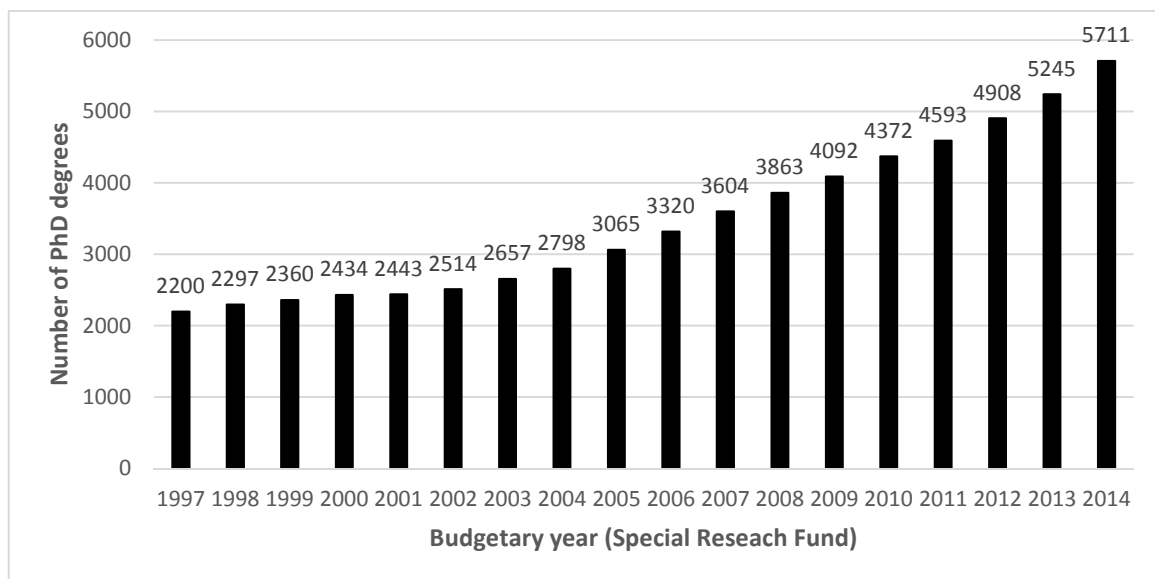


Figure 3: Total number of PhD degrees taken into consideration per budgetary year of the Special Research Fund (BOF).

The number of PhD degrees that are taken into account for parameter A2 of the BOF allocation key per budgetary year also shows a continuous increase (Figure 3). For this parameter the total number of PhD degrees awarded over a moving time frame of 4 academic years are considered: for the budgetary year 1997 of the Special Research Fund, 2,200 PhD degrees were included while for the budgetary year 2014, already 5,711 PhD degrees were taken into account. This represents an increase to 260%.

2.3.3. Parameter A3: gender

The third parameter in this section of the BOF allocation key deals with the gender aspect of the professorial and postdoctoral research staff at the universities. The share of each university in the total number of female

professors and female postdoctoral staff members (expressed in full time equivalents) at the Flemish universities is calculated over a moving time span of the 4 recent calendar years for which registered and audited personnel data are available. The Flemish government maintained this parameter in the recently adjusted allocation key in order to keep on stimulating universities to take up female postdoctoral researchers in their professorial staff.

The weight of this parameter has been set to 2% in 2014 and will remain unaltered in the next years (BVR, 2012).

2.3.4. Parameter B1: publications indexed in Thomson Reuters' databases

The weight of each of the 5 publication categories (articles, letters, notes, reviews, and proceedings papers) within parameter B1 is determined by the proportion of each category in the total number of publications. For this purpose the publications listed in the Conference Proceedings Citation Index-Science (CPCI-S) or in the Conference Proceedings Citation Index-Social Sciences & Humanities (CPCI-SSH) are taken into account with a coefficient of weight of 0.5.

A unique classification model is used to calculate the share of each university in the total number of publications of the Flemish university researchers in scientific journals with an impact factor (BVR, 2012):

- all journals indexed in the SCIE and SSCI are grouped in 68 research disciplines and ranked according to an average impact factor calculated over a moving time span of 10 years. The years for which no impact factor of the journal is known, are not taken into account to determine the average impact factor. A journal occurring in more than one research discipline is only retained in the research discipline list for which it has the relative highest ranked position.
- once all journals are ranked in one of the 68 research disciplines, each journal list is divided into 20 equally sized parts. A specific coefficient of weight is assigned to each of the 20 parts of these ranked lists. The coefficients of weight are identical for all 68 research disciplines and range from 10 (for the journals with the highest average impact factors (top 5% journals)) to 0.1 (for the parts containing the journals with the lowest average impact factors) (Figure 4).
- publications appearing in a journal indexed in the SCIE and SSCI are weighted according to the coefficient of weight of the part of the journal list to which the journal belongs.

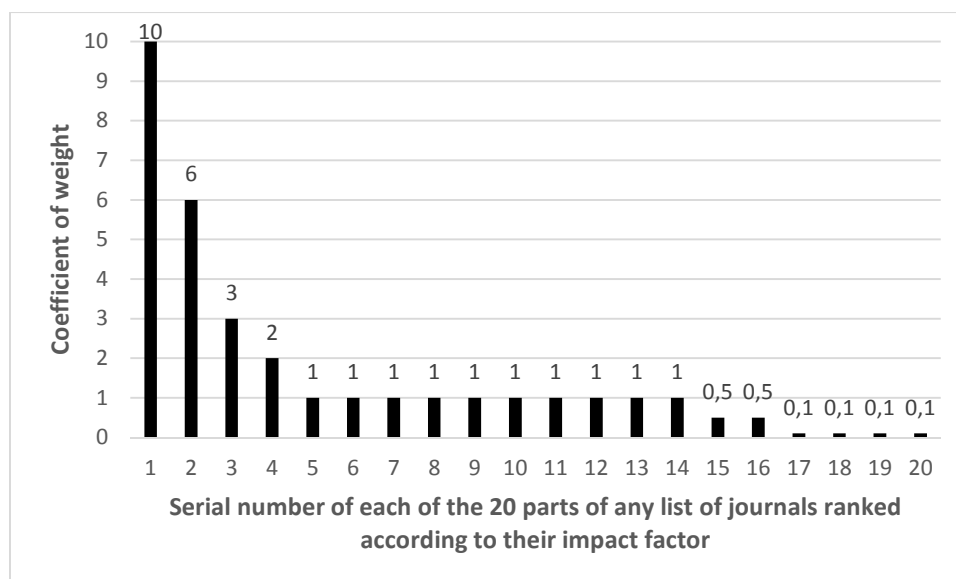


Figure 4: The coefficients of weight used in the framework of parameter B1 of the BOF allocation key.

The goal of this parameter is to encourage publications in highly cited journals within the most relevant research discipline in which one is active. The impact factors are only used to rank the journals within the research discipline. This differs from the counting method used in the past: for several years until 2012 the absolute impact factors were used as weighting criterion. This had the unwanted side-effect that research performed in disciplines with journals with high impact factors appeared to be of more value to the universities

than research performed in other disciplines. The new counting method is discipline neutral and encourages all researchers to aim at publishing in the best journals in their research field (= journals with a high impact factor) regardless of the absolute impact factor of the journal concerned.

The share of each university in the total number of publications in the journals indexed in the Arts and Humanities Citation Index (AHCI), the Conference Proceedings Citation Index-Science (CPCI-S) and the Conference Proceedings Citation Index-Social Sciences & Humanities (CPCI-SSH)) is calculated without using any weight factors: only the gross number of publications are considered.

The weight of this parameter in the BOF allocation key is increasing from 15.36% in 2013 to 16.60% from 2016 onwards (BVR, 2012). In 2015 the weight of this parameter is 16.19% (Figure 1).

2.3.5. Parameter B2: publications indexed in the VABB-SHW database

The share of each university in the total number of publications that are indexed in the VABB-SHW (and that are not indexed in the Thomson Reuters' databases to avoid that these latter publications are counted twice as these are already playing a role in parameter B1) is calculated using weight factors linked to the type of publication considered. As of 2015, books as author are assigned a weight factor of 4. Three other types of publications are assigned a weight factor of 1: edited books, book chapters and journal articles. Conference proceedings are assigned a weight factor of 0.5.

Scientific publications in the Social Sciences and Humanities need to meet a number of basic criteria to be eligible to be indexed in the VABB-SHW: the publications are publicly accessible, are identifiable by an ISBN or an ISSN number, contribute to new insights (or applications resulting from these insights) and underwent a demonstrable peer review procedure prior to publication (Ossenblok et al., 2013). The authors have to prove that peer review was performed by independent peers who are expert in the field of study concerned. As research policy studies are part of the broad field of Social Sciences, publications of the policy advisors at the central administration of universities are also qualified to be indexed by the VABB-SHW on condition that their contributions meet all criteria mentioned.

A minimum number of 4 pages is also implied in order to arbitrarily differ between articles, conference proceedings and book chapters on the one hand and short communications on the other hand. The latter does not represent an eligible publication category in the VABB-SHW.

The weight of this parameter in the BOF allocation key is increasing from 6.28% in 2013 to 6.80% from 2016 onwards (BVR, 2012). In 2015 the weight of this parameter is 6.62% (Figure 1).

2.3.6. Parameter B3: citations

This parameter deals with the share of each university in the total number of citations to articles, notes, letters, reviews and conference proceedings indexed by SCIE or SSCI and authored by at least one staff member belonging to the university concerned. Citations are assigned to a university as soon as the university is mentioned in the address of at least one of the authors of the cited publication. The number of citations is determined using a moving time span of maximum 10 calendar years. For each cited publication the time span starts with the year of publication and lasts up to 10 calendar years.

No difference is made between self-citations and other citations to a publication: a study of Debackere and Glänzel (2004) showed that the different Flemish universities have highly similar self-citation rates and that these rates are relatively stable when a time span of several years is considered. Based on this observation it was decided not to correct for self-citations when determining the share of each university for this parameter.

The weight of parameter B3 in the BOF allocation key is increasing from 15.36% in 2013 to 16.60% from 2016 onwards (BVR, 2012). In 2015 the weight of this parameter is 16.19% (Figure 1).

3. ALLOCATION KEY OF THE INDUSTRIAL RESEARCH FUND

The Industrial Research Fund ("*Industrieel Onderzoeksfonds*"; IOF) represents a second research block grant allocated by the Flemish government to the universities. This public research funding initiative has been installed in 2004 to stimulate applied research and innovation initiatives at all institutes for higher education in Flanders.

The IOF block grant is allocated to associations of higher education institutes. An association is a legal entity established by a consortium of one university and at least one non-university institute for higher education

("hogeschool"). The latter higher education institutes offer on an exclusive basis professional bachelor programmes (180 ECTS). In contrast universities offer on exclusive basis academic bachelor programmes (180 ECTS) and academic master programmes (ranging between 60 and 180 ECTS). The main goal of the associations is to stimulate collaboration between consortium partners in the fields of education, research and services to society. The associations do not have the qualification to offer education, to perform research activities or to provide services to society. These tasks remain the core business of the member institutes of the associations.

The aim of the IOF allocation key is to distribute public research and development funding between the Flemish associations. Within each association the R&D funding is used to set up and support an own innovation policy. For this purpose each association established a so-called IOF Council with a two-fold mission: 1) to prepare innovation related association-wide policy measures and 2) to organize intra-association funding allocation systems based on a peer-review mechanism to support individual innovation initiatives in accordance with the current innovation policy measures. At Ghent University Association a portfolio of funding initiatives (several types of innovation projects, business development centers headed by business development managers) have been developed and annual or biannual calls for proposals are launched within the association. The IOF Council acts as actor in the selection of the "best" innovation proposals.

A specific allocation key has been set up to distribute the available funds among the 5 associations in Flanders (BVR, 2009). As from 2011 this allocation key consists of 6 parameters.

The first 2 parameters take into account the scientific performance of the partners within the associations:

- Parameter 1: the share of each association in the total number of PhD graduates (PhD degrees awarded by the Flemish universities) during a moving time span of 4 recent academic years. This parameter resembles parameter A2 of the BOF allocation key.
- Parameter 2: The average share of the each association in the total number of publications of its members on the one hand and in the total number of citations to publications authored by at least one staff member belonging to a university or non-university institute for higher education on the other hand. The calculation of the association shares for each item of this parameter is based on the calculation method used to determine the university shares in the parameters B1 and B2 (publications) and the parameter B3 of the BOF allocation key (citations). For this IOF parameter more publications and citations are taken into account than for the corresponding parameters in the BOF allocation key as not only the publications of the researchers at the Flemish universities but also the publications of the researchers of the Flemish non-university institutes for higher education are counted as well.

The next 2 parameters deal with the degree in which the members of the associations are successful in attracting external research funding:

- Parameter 3: the share of each association in the total amount of external funds raised by the partners of all associations through agreements with profit organisations (research and development agreements, clinical trials (limited to stages 1 and 2) and licensing agreements) counted during a moving time span of the 4 most recent calendar years.
- Parameter 4: the share of each association in the total amount of European research funds obtained through the most recently closed Framework Programme. For 2015 the results of the Seventh Framework Programme will be used for the first time because the final results of the revenues of universities and non-university institutes of higher education in Flanders via participations in projects funded through the Seventh Framework Programme were available at the time of the assignment of the IOF block grant 2015 among the associations.

The last two parameters take into account the innovation and valorization capacity of the partners in the associations by measuring the numbers of patent applications, granted patents and spin-off companies during a moving time span consisting of the 4 most recent calendar years:

- Parameter 5: the share of each association in the total number of patents granted by the United States Patent and Trademark Office, patents granted by the European Patent Office and applied patents, and patents applied for according to the Patent Cooperation Treaty. The patents and patents applications are weighted using a coefficient of weight of 1 for both types of granted patents and a coefficient of weight of 0.5 for the patent applications.
- Parameter 6: the share of each association in the total number of spin-off companies established by all partners of the associations.

The share of each of the 6 parameters in the allocation key remained constant as from 2011. In the IOF 2015 allocation key the shares range from 10% (parameter 4) over 15% (parameters 1, 2, 5 and 6) to 30% (parameter 3) (Figure 5).

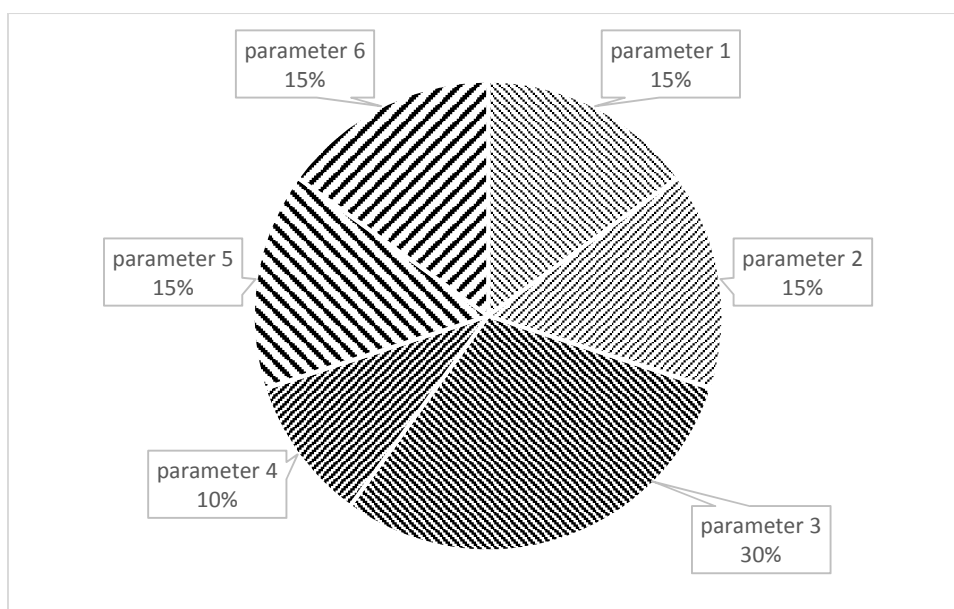


Figure 5: The share of each parameter in the IOF allocation key 2015

4. BLOCK GRANT FUNDING OF THE FLEMISH INSTITUTE FOR BIOTECHNOLOGY

The Flemish Institute for Biotechnology¹ is a virtual research institute in a sense that apart from a central administrative unit, all the other units (research departments) are integrated within universities. The researchers of this institute conduct strategic basic research in life sciences, including molecular biology, cell biology, developmental biology, structural biology, genetics, biochemistry, microbiology, genomics and proteomics. The research departments each consist of several research groups and are fully embedded in the Flemish universities. As a consequence these research groups acquire research funding through both the VIB and the host university as well as through external sources (regional, federal and international funding agencies, companies, ...).

The Flemish government yearly allocates a block grant to the VIB. In return strategic goals which are laid down in a management agreement between the government and the strategic research institute. During the life span of the agreement the goals have to be reached. Every 5 years an international panel of peers assesses not only the scientific impact of the work done by the researchers but also the economic and social impact of it. Based on the assessment report the government decides on the renewal of the management agreement for the next 5 years and on any change in the yearly block grant (Kieft et al., 2011).

The procedure set up for the assessments of the Flemish strategic research centres resembles the new country wide evaluation procedure that has been set up in the UK to assess the quality of research at every higher education institution: the 'Research Excellence Framework (REF)' evaluation that took place for the first time in 2014². The evaluation panels use a combination of peer review and metrics to look not only at the scientific impact but also at the economic and social impact of the work performed by the higher education institutions.

In the management agreement the strategic goals are translated into concrete operational goals linked to a number of key performance indicators. For the time span 2007-2011 the key performance indicators listed in the management agreement were (Kieft et al., 2011):

- 150 publications / year in peer reviewed journals with an impact factor of at least 5, of which 55 publications / year in journals with an impact factor of at least 10;
- 40 PhD degrees awarded to junior VIB researchers / year
- 25 patent applications / year of which is expected that half of them will be granted;
- 6 million euro revenue / year through collaborations with industry
- 1 spin-off company / year

Within the VIB, the key performance indicators are spread among the research departments and specific targets for each of the individual research groups are defined based on these key performance indicators. As

¹ <http://www.vib.be/en/Pages/default.aspx>

² <http://www.ref.ac.uk/>

the research departments of the VIB are integrated into research departments at the Flemish universities the key performance indicators of the VIB are at least as important for the researchers of these departments as the mechanisms used to fund research at universities (block grant funding methods as well as competition-based funding methods).

VIB research groups that underperform have to leave the VIB. In 2012, this was the case for 7 out of the 72 VIB research groups (Kieft et al., 2011). In principle these research groups do not disappear as they continue to work within their host university. However they have to deal with a lower basic budget as the funding flow from the VIB has stopped.

In the current management agreement a new approach to get an approximation of the quality of the VIB publications was introduced. Instead of using strict impact factor cutoffs (e.g. journal impact factors of 5, 10, or even more), the tier journals for each VIB research field were identified by means of a ranked list of peer reviewed journals based on their impact factors. This allows the researchers to zoom in on the top journals in their specific field of research (top 25% (Tier25), top 5% (Tier5) and top 1% (Tier1)) instead of solely focusing on journals with high impact factor (VIB, 2013). This procedure to rank scientific journals within research disciplines is similar to the procedure that has been introduced in the BOF allocation key (parameter B1).

5. COMPETITIVE FUNDING THROUGH THE RESEARCH FOUNDATION - FLANDERS

The Research Foundation - Flanders (FWO)³ is the Flemish funding agency that supports ground-breaking fundamental research at the universities of the Flemish Community. It grants fellowships to excellent and promising researchers as well as research project funding to established researchers on the basis of an interuniversity competition and an evaluation by renowned national and international experts. For this purpose calls for several types of research proposals (projects, fellowships, mobility, international cooperation ...) are launched each year.

The peer review evaluation is carried out by national and international experts and is exclusively driven by scientific excellence. There are 30 mono-disciplinary panels and 1 interdisciplinary panel, together covering all research disciplines present at the universities in Flanders. Each panel counts 16 to 18 members. They are selected on the basis of their scientific expertise. At least half of the members of each panel is not affiliated to a Flemish university. The panels meet twice a year to evaluate the submitted proposals. For postdoctoral fellowships and research projects, the panel members have at their disposal evaluation reports from remote external referees. The panels submit a ranked list of excellent proposals in the form of a scientific advice to the Board of Trustees of the FWO that decides on the allocation of funds.

The evaluation is based on the assessment of the research proposal as well as on the excellence of the previous achievements of the applicant(s) or, in case of an application for a PhD fellowship or postdoctoral fellowship, on the potential to become an excellent researcher in the near future. With regard to the applicant the evaluation is based partly on the assessment of the number and type of scientific publications and of the international visibility of the work of the applicant within the research discipline involved (e.g. citations, invited talks at international conferences,...). It may be clear that the research performance-based parameters of the BOF allocation key indirectly play an important role in the quality assessment exercise of research proposals under the auspices of this Flemish funding agency.

Figure 6 shows the success rate of the candidatures for PhD fellowships and postdoctoral fellowships at the Fund for Scientific Research over the last 15 years: a decrease in success ratio for the applications for PhD fellowships is observed. As from 2010 onwards the success ratio to obtain a PhD fellowship from this funding agency ranges between 21 and 24%.

³ <http://www.fwo.be/en/>

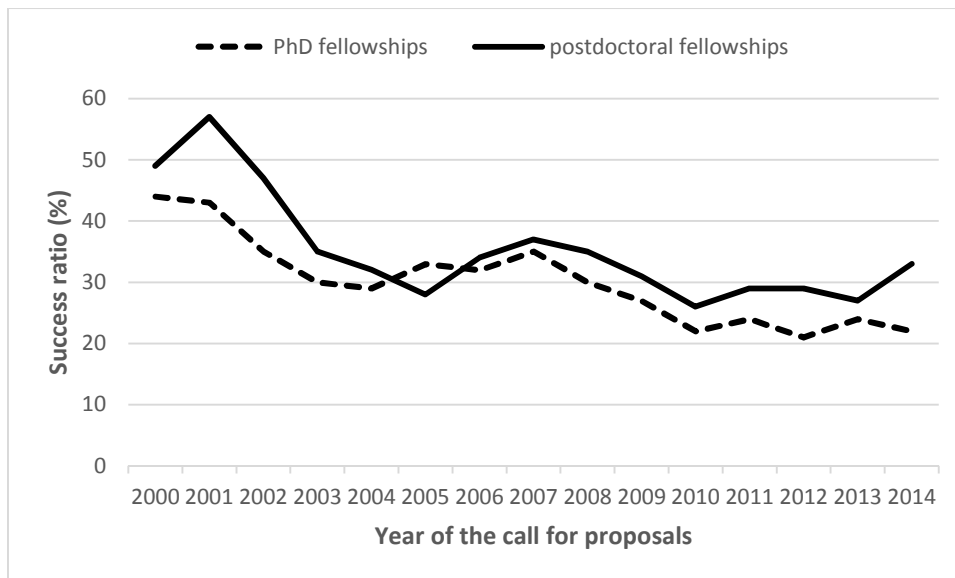


Figure 6: the evolution of the success ratio for the calls for proposals for PhD fellowships and postdoctoral fellowships at the Fund for Scientific Research – Flanders (retrieved from the annual reports of the funding agency).

With regard to the applications for postdoctoral fellowships, the highest success ratios (> 40%) were obtained in the years 2000 till 2002. From then on the success ratio dropped below 40%. Between 2010 and 2013 the success ratio was even lower than 30%.

As the number of yearly available PhD fellowships and fellowships for postdoctoral researchers remained relatively stable, the decrease in success ratio is ascribed in full to an increase in number of applications. This is confirmed by the data published in the annual reports of this funding agency.

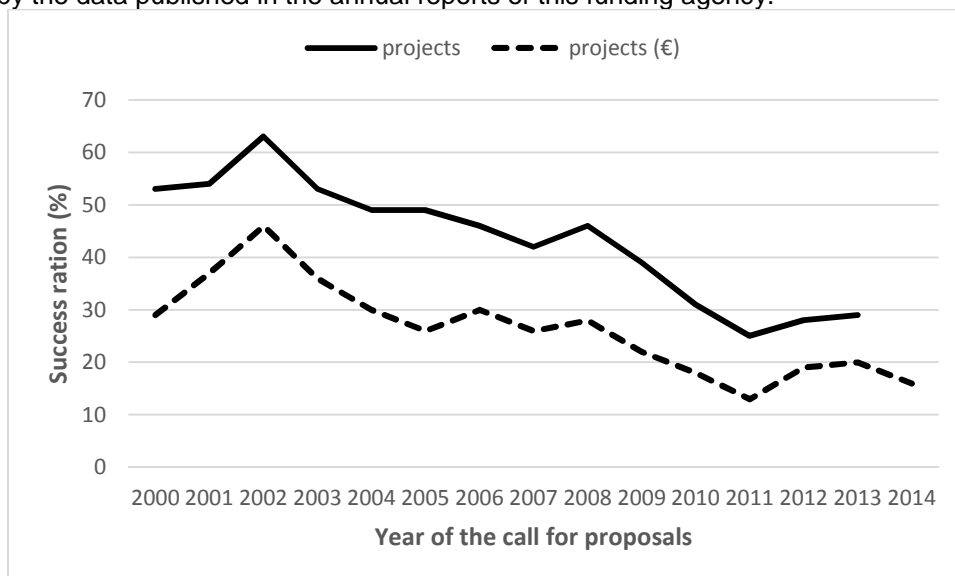


Figure 7: the evolution of the success ratio in the calls for project proposals at the Fund for Scientific Research – Flanders. The success ratios are based on the number of submitted versus the number allocated projects (black line) as well as on the total budget of all submitted proposals versus the total budget of all granted projects (dotted line). Data retrieved from the annual reports of the funding agency.

The success ratio in the framework of the call for project proposals at the Fund for Scientific Research – Flanders is shown in Figure 7. When one focusses on the number of allocated projects a clear decrease in success ratio is observed: while more than 50% of the submitted projects could be granted in the years 2000-2003, the success rate dropped down to less than 30% for the most recent years (2011-2013).

Figure 7 shows that the total budget that was granted to funded research projects when compared to the total budget that was requested in the project applications. While until 2008 the total budget allocated to the selected projects represented at least 25% of the total budget requested, this percentage dropped below 20% as from 2010. The yearly difference observed between both success rates indicates that the evaluation panels, in an attempt to grant as much research projects as possible, also reduce the requested project budgets.

6. SOME REFLECTIONS ON THE PUBLIC FUNDING MECHANISMS IN FLANDERS

In 2015 the Flemish government plans to allocate up to EUR 156 million via the Special Research Fund and approximately EUR 27 million via the Industrial Research Fund. In addition the BOF allocation key and the IOF allocation key are used as a combined allocation key to distribute a total amount of approximately EUR 23 million among the associations for medium-scale and large-scale research infrastructure. On top of that most parameters of the BOF allocation key are also part of another allocation key used to distribute on Flemish level 45% of the total amount of the university basic allowance among the universities. In 2015 this represents a sum of nearly EUR 322 million. It is evident from these figures that the university policy makers pay a lot of attention to the parameters in both allocation keys, especially the parameters dealing with PhD degrees, publications and citations.

Van den Berghe (2014) investigated the effect of national allocation models on the internal allocation systems used by 4 European universities (Ghent University, University of Göttingen, University of Groningen and Uppsala University). Although the universities are dealing with substantially different national/regional allocation models, it was found that in each university the internal allocation system mirrors to a larger extent the state funding allocation system although some tailor-made adaptations were introduced. Their internal models to distribute the basis allowance among the faculties/schools/departments has mainly the same basis architecture and contains the same parameters (or parameters derived from them) as the allocation keys used by the government.

As the Flemish universities aim to increase their share in the allocation keys for research block grants individual researchers experience a growing pressure to publish more and in “better” scientific media (journals, books via renown scientific publishers,...) and to attract more graduate students and to better guide and supervise them so that they are successful in obtaining a PhD degree. The costs linked to the activities that will lead to new research output has to be obtained via various funding sources. For Flemish researchers focusing on fundamental research the Special Research Fund within the home university and the Fund for Scientific Research – Flanders are the obvious sources for funding. Each university decides autonomously on the way the allocation of the money of the Special Research Fund is organised. For at least part of the available funds within the special Research Fund, all Flemish university developed a set of funding initiatives of which most of them are based on project-based competition. At Ghent University less than 10% of the Special Research Fund is not allocated through competition. However, the allocation of even that portion of the available research funds is depending on meeting the performance-based goals that were agreed beforehand and are known to all researchers who can be a promoter of PhD graduates.

Researchers also have to consider the best publication media to reveal their research results. The fact that for several years only a particular segment of publication types (i.e. articles in journals indexed by the Thomson Reuters' databases) were taken into account for determining a partition of the subsidy in the framework of the Special Research Fund and Industrial Research Fund, incited researchers to switch their publication behaviour. Ossenblok et al. (2012) showed that parameters used in a performance-based funding system influences the publishing patterns of researchers in the Social Sciences and Humanities: in contrast to the Norwegian colleagues, the Flemish researchers in these research disciplines switched their publication pattern to articles in journals indexed by the Thomson Reuters' databases. In a recent study Michels & Schmoch (2014) reported that German authors adapt their publication behavior to aim for journals that are more internationally known and have a foreign publisher. A similar observation is made by Schuermans et al. (2010) who studied the publication practices of the Belgian academic geographers over the last 40 years. They observed that the Belgian geographers are currently publishing more in English-language journals and in journals indexed by the Thomson Reuters' databases than their colleagues in the seventies or eighties. The number of publications in the local languages (Dutch and French) and in Belgian geographical journals was decreased. Whether these publication shifts are problematic, as is suggested by Schuermans et al. (2010) in the field of academic geography, remains to be clarified by future studies. Derudder (2011) published some reflections on the dominance of Journals indexed the Thomson Reuters' databases in academic human geography. It is clear that external factors like the use of scientific output-related parameters in public funding mechanisms influence the publication behavior of researchers.

Spruyt & Rons (2008) estimated the average annual financial return of a PhD degree in Humanities over a period of 3 years (2005-2007) at 4,600 EUR. Taking into consideration the coefficients of weight used to differentiate between research disciplines on the basis of the assumed differences in the cost of the research activities, the authors concluded that the average annual financial return of PhD degrees in other disciplines was twice to three times as high (9,200 EUR and 13,800 EUR). On request of the Ghent University Research Council a similar calculation is made yearly focusing on the financial return of PhD degrees in the framework of the Special Research Fund. The average financial return of a PhD degree (regardless of the disciplines in which the degrees are awarded) amounted to 12,500 EUR in 2009 which is likely to be higher than the average that can be assumed from the results mentioned by Spruyt & Rons (2008) for the years 2005 till 2007. This is explained by a financial injection of approximately EUR 40 million by the Flemish government between 2005 and 2009 (ref: Van der Weken et al., 2013).

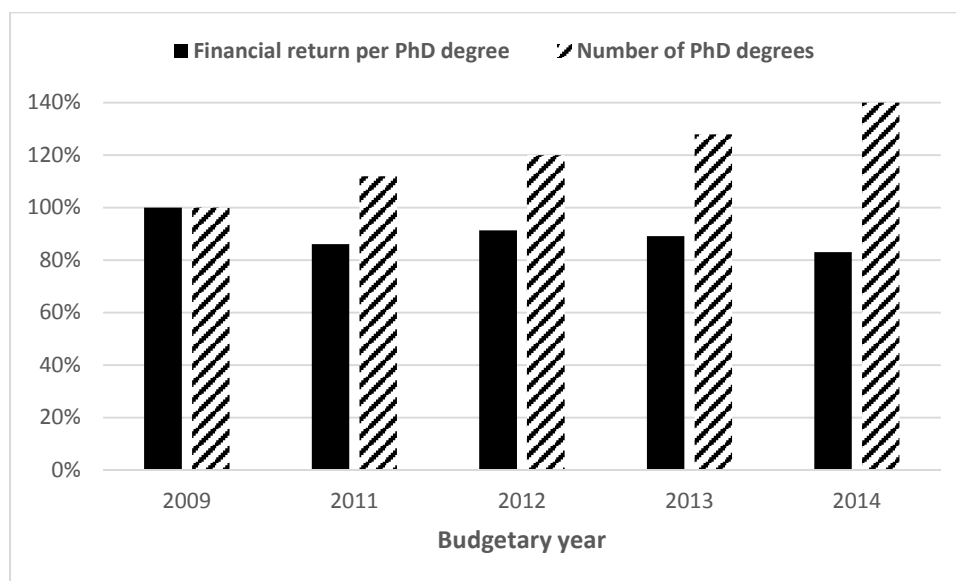


Figure 8: The evolution of the number of PhD degrees counted and the evolution of the financial return per PhD degree between the budgetary years 2009 – 2014 of the Special Research Fund.

Figure 8 shows the evolution of the number of PhD degrees that are taken into account to determine the share of each university in the framework of parameter A2 for the BOF budgetary years 2009 till 2014 on one side, and the average financial return per PhD degree that is counted for the same budgetary years on the other side. The value of both variables for the budgetary year 2009 is set to 100% (corresponding to 4,092 PhD degrees and 12,502 EUR of financial return per PhD degree). In the budgetary year 2014, the number of PhD degrees increased to 140% (representing 5,711 PhD degrees) while the financial return per PhD degree dropped to 83% (10,376 EUR). During the period 2009-2014 the share of this parameter A2 in the allocation key remained unchanged at 35% and no alterations were made in the way the PhD degrees are taken into account. The different course of the curves of both variables has to be ascribed to another cause.

A similar observation is made for parameter B1 (publications in scientific journals indexed by the databases of Thomson Reuters): the average financial return per publication amounted to 295 EUR in 2009 and decreased to 247 EUR in 2014 (-16%) (unpublished results).

Based on data published by Van der Weken et al (2013) the gross amount of the Special Research Fund did not increase as strong as the increase in the number of PhD degrees in recent years: between 2009 and 2013 an increase of only 13.5% has been recorded. In 2014 only a minor additional increase (of $\pm 1\%$) of the Special Research Fund was foreseen by the Flemish government.

An important aspect linked to different course of the curves observed in Figure 8 deals with the closed financial envelope that is being applied by the Flemish government with regard to the Special Research Fund (and the Industrial Research Fund): the amount of money that is distributed among the universities via the different allocation keys does not follow the increase in university output. As a consequence of this, a growing competition between the Flemish universities takes place in order to increase their share in each of the

allocation keys. In fact all universities show an increase in numbers of contributions to the scientific literature and PhD degrees. This is shown by several contributions in Debackere & Veugelers (2013). Despite the efforts to realise a continuous growth in the scientific output and to safeguard, at the same time, the excellence level of the scientific output, the reward for each university is minimal, if present. In fact due to the closed envelope principle an increase in university share in the allocation keys can only be obtained on condition that the other universities do not realize an as strong increase in output as the university considered. As a consequence an increase in share of one university necessarily induces a decrease in the share of at least one other university.

This issue has already been discussed several times with the authorized Flemish ministers. One of the ideas to overcome the lack of an budgetary adjustment linked to the growing research output consists of installing thresholds for each of the parameters of the allocation keys: as soon as the total output in the framework of one of the parameters of an allocation key exceeds the threshold, an additional amount of money could be added by the government to the block grant. The implementation of this principle guarantees that the universities continue to be rewarded for the efforts made to improve the output and visibility of the research activities performed by their research staff. However, a solution on short-term is unlikely due to the economic climate forcing the Flemish government to save on subsidies including those to promote scientific research.

A similar issue deals with the reduction in success rates of research applications submitted in the framework of call for proposals launched by the Fund for Scientific Research – Flanders. The reduction is ascribed to the fall back of available funds to spend on excellent research initiatives by this Flemish funding agency in comparison to the growing number of applications submitted to this agency.

The number of publications and the impact factors of the scientific journals in which one publishes are parameters, among others, that are also used by peers to assess the quality and the expertise of project promoters and of candidates for research fellowships in the framework of the evaluation of applications. Although these parameters are not used in a strict arithmetic approach, they do play an important role in the assessment of the individual applications and in the ranking of applications according to their excellence. The recent introduction in the BOF allocation key of the use of 68 research disciplines to rank scientific journals according to their impact factor introduced a proper recognition of the top journals in research disciplines in which the impact factors are considerably lower than those of the top journals in other research disciplines. In their study on the publication behavior of German scientific authors, Michels & Schmoch (2014) observed a trend from more specialized journals to journals with a broader scope raising the question whether the compartmentalization of journals in predefined research disciplines used to perform bibliometric analyses leads to undesired shifts in conducted research or in choice of most obvious publication media.

The division of the research landscape into research disciplines (68 research disciplines in case of parameter B1 of the BOF allocation key) can never be perfect: researchers active in small or in niche research disciplines have the feeling that their work is underappreciated. In case there are only a few specific peer-reviewed journals available to publish in, these journals are irrevocably added to a list of journals covering a much broader range of research disciplines. This might result in a suboptimal ranking of these journals (including the top journal of the niche research discipline) and consequently in a low coefficient of weight for each of the publications by these researchers at the time the publications are taken into account to determine the university shares in the framework of parameter B1. A similar sigh is raised by researchers performing mainly interdisciplinary research: due to the lack of already established journals focusing on the new awaking research discipline, the researchers are obliged to publish in journals belonging to the more established research disciplines linked to the new research discipline. As the research topic of their work only partially matches with the research focus of the journals, these researchers face significant hurdles to publish in high-ranked journals.

As every attempt to classify research disciplines in categories to be used for metrics purposes and allocation keys, irrevocably shows a certain grade of imperfection, the only alternative to assess quantity and quality of scientific output and research potential, is through labour-intensive peer review. However also the peers will have to use the same and similar criteria and parameters to evaluate research initiatives projects. The only difference is that peers interpret the data before assessing them while the software developed for metrics and allocation purposes only uses the data in a strict arithmetic approach.

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